

# Unit 4: Chemical Reactions, Electromagnetic Spectrum, Waves

Content Area: **Science**  
Course(s):  
Time Period: **Marking Period 4**  
Length: **45**  
Status: **Published**

## Summary

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**Introduction:** In this unit, students will explore chemical reactions, the electromagnetic spectrum, and waves while utilizing the scientific method and problem solving. Given substances, students will predict the reaction type, balance the equation, and classify the reaction as one of the four reaction types. Students will observe the four chemical reactions through labs such as the reaction of metals and acid, the effects of burning carbohydrates, flame tests, and spectroscopy. Students will explore the properties of waves through labs such as the Slinky Lab and Making Waves. Students will gain experience in communicating results, scientific writing, and data representation and analysis through a unit project.

**Revision Date:** July, 2020

CS.K-12.2	Collaborating Around Computing and Design
LA.W.8.1	Write arguments to support claims with clear reasons and relevant evidence.
LA.W.8.1.A	Introduce claim(s), acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
LA.W.8.1.B	Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.
LA.W.8.1.C	Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
LA.W.8.1.E	Provide a concluding statement or section that follows from and supports the argument presented.
LA.W.8.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
LA.W.8.2.B	Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
LA.W.8.2.C	Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
LA.W.8.2.D	Use precise language and domain-specific vocabulary to inform about or explain the topic.
LA.W.8.2.E	Establish and maintain a formal style/academic style, approach, and form.
LA.W.8.4	Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

LA.W.8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
LA.W.8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
LA.W.8.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
LA.RI.8.1	Cite the textual evidence and make relevant connections that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.
LA.RI.8.8	Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.
LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
MA.8.F.A	Define, evaluate, and compare functions.
MA.8.F.A.2	Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.8.F.A.3	Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
MA.8.F.B	Use functions to model relationships between quantities.
MA.8.F.B.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two $(x, y)$ values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
MA.8.F.B.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
MA.8.EE.A.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions.
MA.8.EE.A.3	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.
MA.8.EE.A.4	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.
MA.8.EE.B	Understand the connections between proportional relationships, lines, and linear equations.
MA.8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
MA.8.EE.C.7	Solve linear equations in one variable.
MA.8.EE.C.7b	Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

MA.8.SP.A	Investigate patterns of association in bivariate data.
MA.8.SP.A.1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
MA.8.SP.A.2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.5	Use appropriate tools strategically.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
SCI.MS.PS1.B	Chemical Reactions
SCI.MS.PS3.D	Energy in Chemical Processes and Everyday Life
SCI.MS.PS3.D	Energy in Chemical Processes and Everyday Life
SCI.MS.PS4.B	Electromagnetic Radiation
SCI.MS.ETS1.A	Defining and Delimiting Engineering Problems
SCI.MS.ETS1.B	Developing Possible Solutions
SCI.MS.ETS1.B	Developing Possible Solutions
SCI.MS.ETS1.C	Optimizing the Design Solution
SCI.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.MS-ESS1-3	Analyze and interpret data to determine scale properties of objects in the solar system.

SCI.MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SCI.MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
SCI.MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
SCI.MS-ETS1	Engineering Design
SCI.MS-PS1-6	Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
SCI.MS-PS4	Waves and Their Applications in Technologies for Information Transfer
SCI.MS-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
SCI.MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
SCI.MS-PS4-3	Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.
SCI.MS-PS2-5	Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
SCI.MS-PS3	Energy
SCI.MS-PS1-3	Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
SCI.MS-PS1	Matter and its Interactions
SCI.MS-PS1-5	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
WRK.9.2.8.CAP	Career Awareness and Planning
WRK.9.2.8.CAP.12	Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
TECH.9.4.12.TL	Technology Literacy
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
TECH.9.4.12.TL.2	Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
TECH.9.4.12.IML	Information and Media Literacy
	Communication skills and responsible behavior in addition to education, experience, certifications, and skills are all factors that affect employment and income.

## **Essential Questions/Enduring Understanding**

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### **Essential Questions**

How do scientists communicate?

How and why do scientists predict how substances will react?

Is there a relationship between waves and energy?

### **Enduring Understanding**

Understand how to carry out proper lab safety techniques, create a testable hypothesis and utilize the scientific method.

Understand the relationship between chemical properties and chemical behaviors.

Understand that wave properties are consistent across different mediums.

### **Objective**

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Students will be skilled at identifying reactants, products, and the symbols used in chemical equations.

Students will be skilled at demonstrating how to write balanced chemical equations.

Students will be skilled at using coefficients and subscripts to show how mass is conserved during a chemical reaction.

Students will be skilled at classifying types of chemical reactions as synthesis, decomposition, single-displacement, or double-displacement.

Students will be skilled at comparing and contrasting exothermic and endothermic reactions.

Students will be skilled at describing the effects of catalysts and inhibitors and their role in chemical reactions.

Students will be skilled at explaining what causes waves.

Students will be skilled at describing what the basic parts of a wave are.

Students will be skilled at comparing reflection and refraction.

Students will be skilled at determining the relationship between seismic waves and a reading on a seismograph.

### **Learning Plan**

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Conduct flame test

Discuss the four types of reactions that can take place during an experiment.

Identify the type of reaction taking place by examining a balanced equation.

Identify if a reaction is endothermic or exothermic.

Discuss and distinguish between covalent and ionic bonding.

Bonding Lab: Students will predict and investigate the type of bond holding together a variety of chemicals.

Write a well written lab report.

Define and discuss the distinguishing properties of acids and bases, including household examples, common uses and effects on the body.

Examine pH measurement by discussing the effectiveness of pH paper, how pH paper works and practice measuring solutions with pH paper.

Discuss the causes and effects of acid rain. Examine before and after photos of a variety of structures deteriorated by acid rain.

Discuss the digestive system and the essential roles that acids and bases play in food digestion.

Introduce the Lewis dot structure for drawing elements and the Octet rule.

Discuss how to write and name the chemical formulas for molecular compounds.

Discuss how to use oxidation numbers to find subscripts for these compounds.

Define and discuss how chemical properties determine if an acid/base is strong or weak.

Define and discuss neutralization and how salts form.

## **Assessment**

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Science courses are designed to promote skill attainment. Student progression and pace through which they proceed through the performance tasks is based on their affinity for and ability to reach skill attainment. The teacher will determine formative and summative skill attainment; alternative assessments will be incorporated for each student based on their strengths and challenges.

### **Formative Assessments:**

Worksheets

Exit Tickets

Class Discussion

*Quizzes*

### ***Some Suggested Options:***

*Reaction Types*

*Balancing Reactions*

*pH and Acid/Base*

*Color wheel*

*visible light*

*Infrared/x-rays/ultra violet*

*Wave types*

*Wave properties*

**Bench Marks:**

*Formal Lab Reports/Lab Write-ups*

Lab Work

***Some Suggested Options:***

*Where's the Evidence?*

*Testing pH*

*Making Waves*

*Slinky Lab*

Laboratory Techniques

**Summative:**

*Quizzes*

***Some Suggested Options:***

*Reaction Types*

*Balancing Reactions*

*pH and Acid/Base*

*Color wheel*

*visible light*

*Infrared/x-rays/ultra violet*

*Wave types*

*Wave properties*

*Unit Tests*

***Some Suggested Options:***

*Chemical Reactions and Balancing Equations*

*Electromagnetic Spectrum*

*Waves*

***Alternative:***

*Long-Term Projects*

*Making a musical instrument*

*The Greenhouse Effect*

*Laboratory Practical*

**Materials**

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General lab equipment

General lab kits

General classroom supplies

Safety Equipment

Science Textbook

Physical Science McGraw Hill

Science Explorer Modules Physical Science Prentice Hall

Computer(s)

Smartboard

Access to Internet

Powerpoints

Relevant worksheets/notes

Relevant videos

Relevant virtual activities

Relevant interactive programs

Various Lab Chemicals

Cups

String



Rubberbands

Mirrors

Balloons

Felt

Corks

Pins

Battery

Copper Wire